

CLAIMS

5        1. Steel plate with small occurrence of the Bauschinger effect characterized by having a dual-phase structure substantially comprising a ferrite structure and fine martensite and the fine martensite being present dispersed in the ferrite structure.

10      2. Steel plate with small occurrence of the Bauschinger effect as set forth in claim 1, wherein the fine martensite has grains with a long axis of 10  $\mu\text{m}$  or less and said fine martensite has an area ratio of 10 to 30%.

15      3. Steel plate with small occurrence of the Bauschinger effect as set forth in claim 1 or 2, wherein a ratio of the proportional limit of the compression stress-strain curve before and after being subjected to deformation is 0.7 or more.

20      4. Steel plate with small occurrence of the Bauschinger effect as set forth in any one of claims 1 to 3, containing, by mass%, C: 0.03 to 0.30%, Si: 0.01 to 0.8%, Mn: 0.3 to 2.5%, P: 0.03% or less, S: 0.01% or less, Al: 0.001 to 0.1%, N: 0.01% or less and a balance of iron and unavoidable impurities.

25      5. Steel plate with small occurrence of the Bauschinger effect as set forth in claim 4, further containing, by mass%, one or more of Nb: 0.1% or less, V: 0.3% or less, Mo: 0.5% or less, Ti: 0.1% or less, Cr: 1.0% or less, Ni: 1.0% or less, Cu: 1.0% or less, B: 0.003% or less, and Ca: 0.004% or less.

30      6. Steel plate with small occurrence of the Bauschinger effect as set forth in claim 4 or 5, further containing, by mass%, C: 0.03 to 0.10%, having a Charpy V-notch value in the transverse direction at -20°C of 40J or more, and having a ratio of the proportional limit of the compression stress-strain curve before and after being subjected to deformation of 0.7 or more.

35      7. Steel pipe with small occurrence of the Bauschinger effect, wherein the base material has a dual-

phase structure substantially comprising a ferrite structure and fine martensite which is dispersed in the ferrite structure.

8. Steel pipe with small occurrence of the  
5 Bauschinger effect as set forth in claim 7, wherein the fine martensite has grains of a long axis of 10  $\mu\text{m}$  or less and said fine martensite has an area ratio of 10 to 30%.

9. Steel pipe with small occurrence of the  
10 Bauschinger effect as set forth in claim 7 or 8, wherein a ratio of the proportional limit of the compression stress-strain curve in the circumferential direction before and after expansion of the steel pipe is 0.7 or more.

15 10. Steel pipe with small occurrence of the Bauschinger effect as set forth in any one of claims 7 to 9, containing, by mass%, C: 0.03 to 0.30%, Si: 0.01 to 0.8%, Mn: 0.3 to 2.5%, P: 0.03% or less, S: 0.01% or less, Al: 0.001 to 0.1%, N: 0.01% or less, and a balance 20 of iron and unavoidable impurities.

11. Steel pipe with small occurrence of the Bauschinger effect as set forth in claim 10, further containing, by mass%, one or more of Nb: 0.1% or less, V: 0.3% or less, Mo: 0.5% or less, Ti: 0.1% or less, Cr: 25 1.0% or less, Ni: 1.0% or less, Cu: 1.0% or less, B: 0.003% or less, and Ca: 0.004% or less.

12. Steel pipe with small occurrence of the Bauschinger effect as set forth in claim 10 or claim 11, further containing, by mass%, C: 0.03 to 0.10%, having a 30 Charpy V-notch value in the transverse direction at -20°C of 40J or more, and having a ratio of the proportional limit of the compression stress-strain curve before and after being subjected to deformation of 0.7 or more.

13. A method of production of steel plate with 35 small occurrence of the Bauschinger effect as set forth in claim 5, comprising heating steel plate containing, by mass%, C: 0.03 to 0.30%, Si: 0.01 to 0.8%, Mn: 0.3 to

2.5%, P: 0.03% or less, S: 0.01% or less, Al: 0.001 to 0.1%, and N: 0.01% or less and further, optionally, one or more of Nb: 0.1% or less, V: 0.3% or less, Mo: 0.5% or less, Ti: 0.1% or less, Cr: 1.0% or less, Ni: 1.0% or less, Cu: 1.0% or less, B: 0.003% or less, and Ca: 0.004% or less, and a balance of iron and unavoidable impurities, to 760 to 830°C, then quenching it.

14. A method of production of steel pipe with small occurrence of the Bauschinger effect as set forth in claim 11, comprising heating steel pipe having a base material comprised of as ingredients, by mass%, C: 0.03 to 0.30%, Si: 0.01 to 0.8%, Mn: 0.3 to 2.5%, P: 0.03% or less, S: 0.01% or less, Al: 0.001 to 0.1%, and N: 0.01% or less and further, optionally, one or more of Nb: 0.1% or less, V: 0.3% or less, Mo: 0.5% or less, Ti: 0.1% or less, Cr: 1.0% or less, Ni: 1.0% or less, Cu: 1.0% or less, B: 0.003% or less, and Ca: 0.004% or less, and a balance of iron and unavoidable impurities, to 760 to 830°C, then quenching it.

15. A method of production of steel pipe with small occurrence of the Bauschinger effect as set forth in claim 11, comprising hot rolling a steel slab containing, by mass%, C: 0.03 to 0.30%, Si: 0.01 to 0.8%, Mn: 0.3 to 2.5%, P: 0.03% or less, S: 0.01% or less, Al: 0.001 to 0.1%, and N: 0.01% or less and further, optionally, one or more of Nb: 0.1% or less, V: 0.3% or less, Mo: 0.5% or less, Ti: 0.1% or less, Cr: 1.0% or less, Ni: 1.0% or less, Cu: 1.0% or less, B: 0.003% or less, and Ca: 0.004% or less and a balance of iron and unavoidable impurities to obtain a steel plate, roll-forming this into a tubular shape, eletric-resistance-welding its seam to obtain ERW pipe, heating to 760 to 830°C, then water cooling.

16. A method of production of steel pipe with small occurrence of the Bauschinger effect as set forth in claim 15, further comprising, after the ERW, heat treating the seam by heating the seam weld zone to the Ac<sub>3</sub>

point or more, heating to 760 to 830°C, then water cooling.

17. A method of production of steel pipe with small occurrence of the Bauschinger effect as set forth in  
5 claim 15 or 16, wherein the hot rolled steel plate has a ferrite+pearlite structure or ferrite+bainite structure.